REMARKS

Claims 1-41 are all the claims presently pending in the application. Claims 1-2, 4-10, 13-18, 20-23, 25-32, and 35-41 have been amended to more clearly define the invention. Claims 1, 4, 13 and 40 are independent.

Applicant gratefully acknowledges that claims 40-41 are allowed, and that claims 5-7, 9-12, 15-19, 25-29 and 36-39 would be allowable if rewritten in independent form. However, Applicant respectfully submits that all of the claims are allowable.

Entry of this §1.116 Amendment is proper. Since the amendments above narrow the issues for appeal and since such features and their distinctions over the prior art of record were discussed earlier, such amendments do not raise a new issue requiring a further search and/or consideration by the Examiner. As such, entry of this Amendment is believed proper and Applicant earnestly solicits entry. No new matter has been added.

These amendments are made only to more particularly point out the invention for the Examiner and not for narrowing the scope of the claims or for any reason related to a statutory requirement for patentability.

Applicant also notes that, notwithstanding any claim amendments herein or later during prosecution, Applicant's intent is to encompass equivalents of all claim elements.

Claims 1-4, 8, 13-14, 20-21, 24, 30-31 and 34-35 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over D'Amico, et al. (U.S. Patent No. 5,127,100), in view of D'Amico, et al. (U.S. Patent No. 5,159,593). Claims 22-23 and 32-33 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over D'Amico, et al. (U.S. Patent No. 5,127,100), in view of D'Amico, et al. (U.S. Patent No. 5,159,593), in further view of Horiguchi (U.S. Patent No. 5,737,329).

These rejections are respectfully traversed in the following discussion.

I. THE CLAIMED INVENTION

The claimed invention is directed to an automobile communications method for an on-board mobile station across a plurality of radio zones which are consecutively arranged along a road. The method includes providing each of the radio zones with a plurality of communication frequencies, switching between the plurality of communication frequencies within each of the radio zones using a time division scheme such that a different time slot is allocated for each adjoining radio zone for each of the plurality of communication frequencies, and switching a time slot allocated to the on-board mobile station to continuously communicate with the on-board mobile station across the plurality of radio zones.

As explained by the present specification, conventional communication systems use a Time Division Multiple Access (TDMA) communication protocol in which different time slots are used at the same frequency. These TDMA systems enable a wide frequency range to be used. However, it is necessary to increase transmission power by an amount which corresponds to the increase in noise to obtain a desired carrier to noise ratio. Additionally, various distortions deteriorate performance. Further, wide-band devices are needed.

By contrast, the present invention provides a novel system having advantages of both Frequency Division Multiple Access (FDMA) and TDMA systems by arranging a plurality of frequencies in each radio zone and switching these frequencies in a time division mode within each radio zone and also by switching time slots for each frequency between adjoining radio zones. In other words, continuous communication is allowed at the same frequency for a mobile station and the frequency range of each of a plurality of frequencies is substantially equivalent to that of an existing FDMA system.

Additionally, the present invention has a further advantage in that interference between adjoining zones can be avoided. Each zone communicates using a plurality of frequencies and switches between these plurality of frequencies in time division manner which is coordinated with adjoining radio zones so that adjoining radio zones do not communicate simultaneously using the same frequency.

In this case, as long as the same frequency is not selected at the same time between adjoining zones, then time slot positions used in adjoining zones are arbitrarily selected. In other words, it is not necessary to select different time slots between adjoining zones. On the other hand, when a communication frequency is switched, if the same frequency can be selected at the same time between adjoining zones, then different time slots are allocated between adjoining zones.

II. THE PRIOR ART REJECTIONS

A. The D'Amico et al. '100 reference in view of the D'Amico et al. '593 reference

Regarding the rejection of claims 1-4, 8, 13-14, 20-21, 24, 30-31 and 34-35, the Examiner alleges that the D'Amico et al. '593 reference would have been combined with D'Amico et al. '100 reference to form the claimed invention. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, the Examiner does not even support the combination by identifying a reason for combining the references.

Rather, the Examiner alleges that it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teaching of the D'Amico et al. '100 reference with the teaching of the D'Amico et al. '593 reference "so that the subscriber may consider handoff to another cell base station with adequate signal level." However, contrary to the Examiner's allegation not only does the D'Amico et al. '100 reference already disclose a system that allows a subscriber to consider handoff to another cell base station with adequate signal level and, therefore, does not require any modification to achieve this objective, but the alleged modification has absolutely nothing to do with achieving that objective.

The D'Amico et al. '100 reference discloses a digital radio communication system which includes a radio that can evaluate the signal of adjacent cells for determining an appropriate cell for hand-off purposes (Abstract). The D'Amico et al. '100 reference teaches that conventional communications systems rely upon a central controller to instruct the roving radio as to which frequency it should switch in order to access another cell for reliable communication (col. 1, lines 21-24). This approach requires a substantial infrastructure and the D'Amico et al. '100 reference explains that it is desirable for the roving station to make the cell hand off determination (col. 1, lines 36-40).

The D'Amico et al. '100 reference addresses this desire by providing a roving station with means to determine which of adjacent cells are suitable for radio communication (col. 1, lines 46-48). More specifically, the D'Amico et al. '100 reference discloses that the roving radio "regularly checks the signal strength of adjacent cells." (col. 4, lines 18-19) and that if the radio determines that another cell has a higher signal strength for a period of time, the radio requests service from that cell (col. 4, lines 22-25). Therefore, contrary to the

Examiner's allegation, one of ordinary skill in the art at the time of the invention would not have been motivated to modify the communication system disclosed by the D'Amico et al. '100 reference "so that the subscriber may consider handoff to another cell base station with adequate signal level" because the D'Amico et al. '100 reference already performs that function.

Additionally, contrary to the Examiner's allegation, the Examiner's alleged modification of "switching a time slot allocated to the on-board mobile station to continuously communicate with the on board mobile station over the radio zones" has absolutely nothing to do with ensuring that "the subscriber may consider handoff to another cell base station with adequate signal level." Rather, the D'Amico et al. '593 reference merely describes the process for performing a switch between cells only after a cell with a stronger signal level has been identified, requested and approved. The D'Amico et al. '593 reference describes a subscriber system which measures the signal strength of outbound (i.e. base-to-subscriber) time slots, and compares their relative levels (col. 2, lines 49-51 and col. 3, lines 34-38). The D'Amico et al. '593 reference explains that the subscriber, the base station or both may request a time slot change if a bit error rate for the current time slot exceeds a predetermined threshold (col. 3, line 65 - col. 4, line 2).

Further, the D'Amico et al. '593 reference explains that after the subscriber determines that a new cell has a stronger signal level than the current cell base station that the subscriber communicates with the new base station to determine a new time slot (col. 4, lines 9-17). The new cell base station then informs the controller to route the call to the new cell base station (col. 4, lines 18-21). Only then, does the Examiner's cite in the D'Amico et al. '593 reference have any relevance at all. At col. 4, lines 21-24, the D'Amico et al. '593

reference explains that the new cell base station then informs the subscriber to switch to the new time slot. Therefore, the switch to the new time slot by the subscriber is only for the purpose of actually performing the switch after the subscriber has determined that the new cell has a stronger signal level than the current cell (col. 4, lines 9-17), and after the new cell accepts the request for a transfer by identifying a new time slot and informs the controller to route the call to the new cell base station (col. 4, lines 18-21).

Therefore, one of ordinary skill in the art would not have been motivated to modify the teaching of the D'Amico et al. '100 reference by providing a subscriber in a time division multiple access (hereinafter "TDMA") system which switches time slots to switch to a new cell for the purpose of ensuring that "the subscriber may consider handoff to another cell base station with adequate signal level" because the method of switching between cells has absolutely nothing to do with identifying a new cell base station with an adequate signal level."

Moreover, the Examiner's alleged modification is also not necessary because the D'Amico et al. '100 reference already discloses that adjacent cells may use the same frequency yet communicate over multiple channels by using a TDMA system. In particular, the D'Amico et al. '100 reference provides one example of such a system where "cell 12 can use the first 32 inbound and outbound slots while cell 11 can use the last 32 inbound and outbound slots of a frame." (col. 3, lines 38-40). Therefore, in order for a subscriber to switch between communications through cell 12 to the cell 11, the subscriber must switch time slots.

Therefore, there is no reason to make any modification to the D'Amico et al. '100 reference to "switch a time slot allocated to the on-board mobile station to continuously

communicate with the on board mobile station over the radio zones" as alleged by the Examiner because the D'Amico et al. '100 reference discloses a system which already has this feature. Thus, one of ordinary skill in the art would not have been motivated to modify the teachings of the D'Amico et al. '100 reference based upon the teachings of the D'Amico et al. '593 reference as alleged by the Examiner.

Even assuming arguendo that one of ordinary skill in the art would have been motivated to combine these references, the combination would not teach or suggest each and every element of the claimed invention.

Contrary to the Examiner's allegation, the D'Amico et al. '100 reference does not teach or suggest simultaneously providing each of the radio zones with a plurality of communication frequencies. Rather, the D'Amico et al. '100 reference discloses that "adjacent cells operate on different frequencies to avoid interference" (col. 1, lines 17-19). In other words, each cell has a frequency which is different than the adjacent cells. More particularly, the D'Amico et al. '100 reference explains that as a roving station moves between cells that "it is necessary for a central controller to instruct the roving station as to which frequency it should move in order to access another cell." (Col. 1, lines 20-24). The D'Amico et al. '100 reference further explains that the communication system includes a plurality of cells having different "operating characteristics" (col. 1, lines 42-46) and that these "operating characteristics can include frequency of operation, bet rate, and/or communication slot information" (emphasis added, col. 1, line 67 - col. 2, line 2). The D'Amico et al. '100 reference further explains that the roving station may include a memory means for storing "the frequency, bit rate and time slot assignment of adjacent cells" (emphasis added, col. 2, lines 4-6).

The D'Amico et al. '100 reference further explains that while each cell has its own unique operating frequency that each cell is capable of communicating with multiple roving stations by using a TDMA system within that cell (col. 2, lines 55 - 68). In particular, the D'Amico et al. '100 reference explains that the data frame for each cell may be "further subdivided into slots which for example can correspond to communication to or from a particular radio within the cell." (col. 2, lines 65-68). Thus, the D'Amico et al. '100 reference provides the ability for each cell to communicate with multiple roving stations by using a TDMA system within each cell and prevents interference between cells by assigning each cell with a unique frequency.

With regard to avoiding interference, the D'Amico et al. '100 reference explains that two approaches may be used. "The first approach involves utilizing different frequencies for the individual cells (FDMA)." Applicant points out to the Examiner that this is the same language used at col. 1, lines 17-19 which is cited by the Examiner. However, the D'Amico et al. '100 reference further explains that as the number of cells increases that the number of remaining available frequencies dwindle and that the number of available frequencies may not be able to accommodate all of the cells (col. 3, lines 27-29). This problem exists because each cell is assigned a single frequency.

The D'Amico et al. '100 reference further explains the second approach of allowing "the same frequency" to be used by adjacent or remote cells provided that the cells do not utilize the same time slots (col. 3, lines 36-38). Thus, "the number of cells which could utilize the same frequency by utilizing different slots, is limited only by the required number of slots for individual cells." (emphasis added, col. 3, lines 40-43). Therefore, contrary to the Examiner's allegations, nowhere within the D'Amico et al. '100 reference is there any

teaching at all that each cell may be simultaneously provided with a plurality of communication frequencies.

The Examiner also cites col. 6, lines 24-26 of the D'Amico et al. '100 reference in a failed attempt to support the Examiner's allegation that the D'Amico et al. '100 reference teaches that each cell may be simultaneously provided with a plurality of communication frequencies. Contrary to the Examiner's allegation this portion of the D'Amico et al. '100 reference merely teaches that "the adjacent cells base stations operate using different transmit and receive frequencies." In other words, this portion of the D'Amico et al. '100 reference merely explains that the frequency used in one of the adjacent cells is different than the frequency used in the other of the adjacent cells. This portion of the D'Amico et al. '100 reference does not teach that each cell may be simultaneously provided with a plurality of communication frequencies.

Next, the Examiner alleges that the D'Amico et al. '100 reference "inherently" teaches "switching a communication frequency used in each of the radio zones in order for the adjacent cells to operate on different frequencies" and cites col. 3, lines 45-47. The Applicant does not contradict this assertion. However, Applicant respectfully submits that the D'Amico et al. '100 reference does not teach or suggest switching between the plurality of communication frequencies within each of the radio zones using a time division scheme such that a different time slot is allocated for each of the plurality of communication frequencies in adjoining radio zones. Rather, as pointed out by the Examiner, the D'Amico et al. '100 reference merely teaches that the operating characteristics (including the frequency) of each base station may be changed. However, the D'Amico et al. '100 reference does not teach or suggest making such a change in frequency using a time division scheme such that a different

time slot is allocated for each of the plurality of communication frequencies in adjoining radio zones as the present invention.

The Examiner also alleges that the D'Amico et al. '100 reference discloses "controlling a communication frequency used in each of the radio zones in tithe (sic) division scheme such that simultaneous transmission at a same communication frequency is not permitted in adjoining radio zones" and cites col. 1, lines 17-19 and col. 6, lines 24-26 in an attempt to provide support for this allegation. However, contrary to the Examiner's allegation the D'Amico et al. '100 reference does not teach or suggest this feature. Rather, as explained above, col. 1, lines 17-19 merely recites "Typically adjacent cells operate on different frequencies to avoid interference" and col. 6, lines 24-26 recites "the adjacent cells base stations operate using different transmit and receive frequencies."

In other words, the D'Amico et al. '100 reference explains that each radio zone has its own unique radio frequency, as explained above in relation to the FDMA system. These passages have absolutely nothing to do with switching of frequencies in the cells, let alone switching the frequencies in a time division scheme within each cell such that a different time slot is allocated for each adjacent radio zone and such that adjacent radio zones are capable of using the same one of the plurality of frequencies but in different time slots.

Contrary to the Examiner's allegations, the D'Amico et al. '100 reference discloses either: 1) maintaining the roving station in communication with the base station at a single frequency, where all communications take place on that single frequency and providing the ability to provide multiple access by time dividing between each channel and causing the roving station to switch time slots as it switches communications between base stations (generic TDMA); OR 2) providing each base station with its own unique frequency,

providing multiple access for each station by time dividing and requiring the roving station to switch frequencies and potentially switch time slots as it switches between base stations.

Similarly, the D'Amico et al. '593 reference only discloses a generic time division scheme without disclosing anything at all about changing frequencies. In summary, the D'Amico et al. '593 reference merely discloses the same generic TDMA system which is disclosed by the D'Amico et al. '100 reference.

None of the applied references teach or suggest the features of the present invention including: 1) switching between a plurality of communication frequencies within each radio zone using a time division scheme; 2) such that a different time slot is allocated for each adjacent radio zone for each of the plurality of communication frequencies, let alone these features in combination with 3) adjacent radio zones using the same communication frequency but with different time slots; and 4) switching the time slot allocated to the on-board mobile station to continuously at one of the communication frequencies.

Therefore, the Examiner is respectfully requested to withdraw this rejection of claims 1-4, 8, 13-14, 20-21, 24, 30-31 and 34-35.

B. The D'Amico et al. '100 reference in view of the D'Amico et al. '593 reference in view of the Horiguchi reference

Regarding the rejection of claims 22-23 and 32-33, the Examiner alleges that the D'Amico et al. '593 reference would have been combined with D'Amico et al. '100 reference and that the Horiguchi reference would have been combined with the D'Amico et al. '100 and D'Amico et al. '593 references to form the claimed invention. Applicant submits,

however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, the references are directed to completely different matters and problems.

Specifically, the D'Amico et al. '100 reference is directed to providing a means for a roving station to determine which of adjacent cells are suitable for radio communication (col. 1, lines 46-48). Similarly, the D'Amico et al. '593 reference is specifically directed to providing a subscriber unit which is capable of determining with which base station to communicate (col. 1, lines 55-59).

Therefore, the D'Amico et al. '100 reference is directed to reducing the complexity of an installed infrastructure by providing a roving station which is capable of determining between which cells the roving station should be transferred (col. 1, lines 11-41 and 45-48) using a Time Division Multiple Access (TDMA) system (col. 2, lines 63-65) or a Frequency Division Multiple Access (FDMA) system or a combination of TDMA and FDMA (col. 3, lines 22-48). The D'Amico et al. '593 reference is specifically directed to a subscriber transmitting a request for a channel assignment from a base station in accordance with a "set of criteria" (col. 1, lines 44-59) for a TDMA system (col. 1, lines 44-46).

In contrast, the Horiguchi reference is directed to a spread spectrum (CDMA) communication apparatus which is able to perform multiple communications without requiring an increase in the scale of pseudo noise code generators (col. 2, lines 16-20).

While a TDMA system and an FDMA system may be compatible with each other in that a receiver can completely separate the signals arriving on different physical channels, a

CDMA system is not at all compatible with either of a TDMA or FDMA system, since the output of a receiver contains small components of all the input signals in a CDMA system. Therefore, since CDMA systems are fundamentally different from TDMA and FDMA systems, one of ordinary skill in the art would not have been motivated to combine the teachings of the Horiguchi reference with either of the D'Amico et al. '100 reference or the D'Amico et al. '593 reference.

Additionally, as explained above, the CDMA system disclosed in the Horiguchi reference is fundamentally different from the claimed invention. Contrary to the Examiner's assertion, the demodulator disclosed in the Horiguchi reference would not be operable in either of the systems disclosed in the D'Amico et al. '100 reference or the D'Amico et al. '593 reference. The demodulator disclosed in the Horiguchi reference at col. 2, lines 28-31 demodulates the reverse spread spectrum received signal. By contrast, the systems disclosed in the D'Amico et al. '100 and the D'Amico et al. '593 references do not operate based upon a spread spectrum. Thus, the references would not have been combined, absent hindsight.

Even assuming arguendo that one of ordinary skill in the art would have been motivated to combine these references, the combination would not teach or suggest each and every element of the claimed invention. The Horiguchi reference, like the D'Amico et al. '100 and D'Amico et al. '593 references, does not teach or suggest the features of the present invention including: 1) switching between a plurality of communication frequencies within each radio zone using a time division scheme; 2) such that a different time slot is allocated for each adjacent radio zone for each of the plurality of communication frequencies, let alone these features in combination with 3) adjacent radio zones using the same communication

frequency but with different time slots; and 4) switching the time slot allocated to the on-board mobile station to continuously at one of the communication frequencies.

Therefore, the Examiner is respectfully requested to withdraw this rejection of claims 22-23 and 32-33.

III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing amendments and remarks, Applicant respectfully submits that claims 1-41, all the claims presently pending in the Application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the Application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 6/9/03

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CERTIFICATION OF FACSIMILE TRANSMISSION

I hereby certify that I am filing this Amendment by facsimile with the United States Patent and Trademark Office to Examiner Nghi H. Ly, Group Art Unit 2682 at fax number (703) 872-9314 this 9th day of June, 2003.

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